



Certification Report for the Base Engineering ASK Remote FCC Part 15 & RSS-210

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Release Control Record

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Document Release Approval	Steve Tippet	Manager, Product Engineering and Verification	 Oct 10, 2006 For Steve Tippet
Author	Denis Lalonde	Radio Compliance Discipline Leader	 Oct. 10, 2006
Technical Reviewer	Jacques Rollin	EMC Advisor	 Oct 10 2006

Accreditations

Solelectron EMS Canada Inc.'s (SDE) test facilities are accredited by the Standards Council of Canada (SCC) to ISO/IEC 17025:2005 [15] in accordance with the scope of accreditation outlined at the following web site http://palcan.scc.ca/specs/pdf/95_e.pdf [2]. The SCC is a signatory of the APLAC [12] and ILAC [13] accreditation organizations.



Solelectron EMS Canada Inc.'s (SDE) quality management system is registered to ISO 9001: 2000 [16] and its processes are documented in the SDE Quality Manual [3] and Lab Operations Manual [4].

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1. Executive Summary

This test report documents the measurements performed on the Base Engineering ASK Remote as part of a Original Equipment Certification for FCC Part 15 and Industry Canada RSS-210.

On the basis of measurements performed in September 2006, the Base Engineering ASK Remote is verified to be compliant with FCC Part 15 and Industry Canada RSS-210 requirements. The test data included in this report apply to the product titled above manufactured by Base Engineering Inc.

This transmitter is a manual operated device and its frequency of operation is 433.92 MHz.

The FCCID and Industry Canada certification numbers for this equipment are the following:

FCCID: N8KJ8T6J11

CANADA: 6657A-J8T6J11

A detailed summary of compliance results is found in Table 2-1: Compliance Results Summary on page 7.

2. Compliance Summary

This section summarizes all the measurements performed on the Base Engineering ASK Remote and its compliance to FCC Part 15, and Industry Canada RSS-210.

Table 2-1: Compliance Results Summary

Product Summary					
Product Name:	the Base Engineering ASK Remote		Project Leader:		Denis Lalonde
Product Code:	ASK400Tx		Measurements by :		S. Turner, D. Lalonde
Product Status:			Date:		September 30, 2006
Test Cases					
Performed	Description	Specification	Test Results		Notes
			Pass	Fail	
■	Transmission Holdover Time	FCC Part 15.231 & IC RSS 210 section A1.1	■	<input type="checkbox"/>	
■	Field Strength of Emissions	FCC Part 15.231 & IC RSS 210 section A1.1	■	<input type="checkbox"/>	
■	Occupied Bandwidth	FCC Part 15.231 & IC RSS 210 section A1.1	■	<input type="checkbox"/>	

3. Equipment Under Test (EUT)

3.1 Product Functional Description

The product trade name of the unit tested is “the Base Engineering ASK Remote”.

This system provides multi-channel / multi-function controls for bulk fuel delivery operation. The most common applications are for Clutch/PTO, Hose Reel, Throttle, Emergency Stop and “Query” control.

Figure 3-1 provides a picture of the tested product.

Figure 3-1 Product Description



3.2 Manufacturer Information

Company Name	Base Engineering Inc.
Mailing Address	600 Rothesay Ave, Saint-John, New-Brunswick, Canada, E2H 2H1
Product Name	Base Engineering ASK Remote

3.3 Transmitter Specifications

Table 3-1 lists the specifications of the transmitter under test

Table 3-1: Transmitter Specifications

Transmitter Characteristic	
Operation control	Manual
Tx Field Strength	< 80.8 dBuV/m (average detector) at 3 m
Tx frequency	433.92 MHz
Antenna	Integral to the unit

3.4 System Components

The system tested consists of the following units, as shown in Table 3-2.

Table 3-2: Components

Component	Model	Serial Number
ASK Remote	ASK400Tx	24168

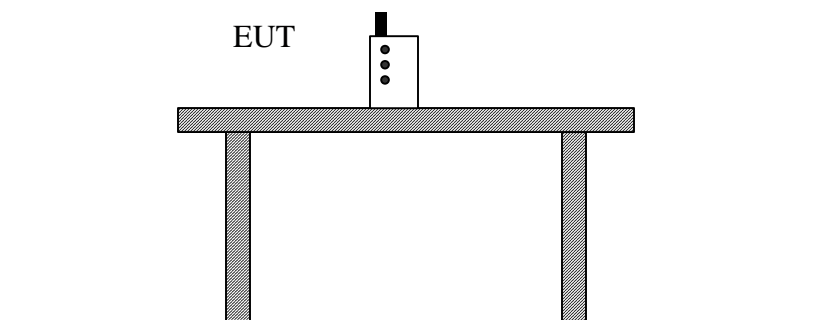
3.5 Support Equipment

No support equipment was required

3.6 System Set-up and Test Configurations

The system configuration used for all test cases is presented in Figure 3-2.

Figure 3-2: Test Configuration



A photograph of the test setup used in this test report is presented in Appendix B: Test Set-up Photographs, on page 25.

3.7 EUT Interfaces and Cables

The EUT has no cables.

3.8 System Modifications

No modifications were required to pass the requirements.

4. General Test Conditions

4.1 Test Facility

Radiated emissions testing was performed in a 10-meter Ambient Free Chamber (AFC) located at 21 Richardson Side road, Kanata, Ontario, Canada. The AFC consists of a shielded room lined with ferrite tiles and anechoic material.

These test facilities are accredited by the Standards Council of Canada (SCC) [2]. Through a Mutual Recognition Agreement (MRA) between the National Voluntary Laboratory Accreditation Program (NVLAP) and SCC, the accreditation status of the AFC facility is valid for the U.S.

4.2 Measurement Instrumentation

The measurement instrumentation conforms to ANSI C63.2 [6] and CISPR 16 [7]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5. Detailed Test Results

5.1 Transmitter Holdover Time

5.1.1 Test Specification

The transmitter holdover time was evaluated according to the specifications listed in Table 5-1:

Table 5-1: Transmitter Holdover Time Requirement

Requirement	Part / Section
FCC Part 15	15.231 a) 1)
RSS-210	A1.1.1 (1)

5.1.1.1 Limits

The specified limit is shown in Table 5-2.

Table 5-2: Transmitter Holdover Time Limit

Maximum Holdover (sec.)
5

5.1.2 Test Facility Information

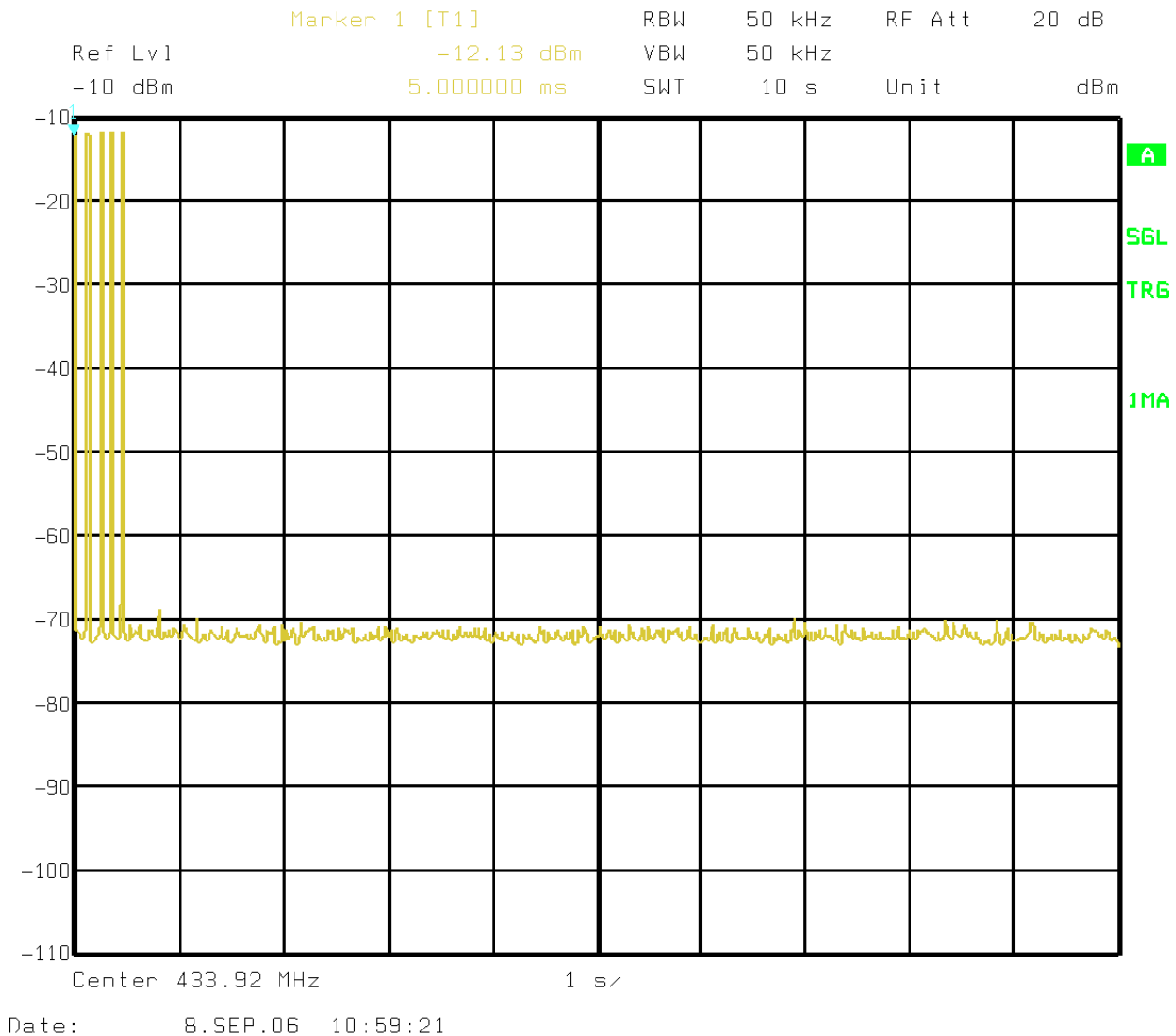
Location: Soletron Design and Engineering Lab 1
Date tested: September 8, 2006
Tested by: Denis Lalonde

5.1.3 Test Procedure

The transmitter was momentarily keyed and the transmitted signal was observed on a spectrum analyzer over a period of 10 seconds. The spectrum analyzer was triggered by the on-ramp of the transmitted pulses.

5.1.4 Test Results

The figure below shows the recorded holdover time.

Figure 5-1: Measured Transmitter Holdover Time

The transmitter holdover time is less than 5 seconds.

5.1.5 Test Conclusion

The test results meet the requirements defined Table 5-1.

5.1.6 Test Equipment List

Table 5-3: Test Equipment used for Occupied bandwidth

Category	Manufacture	Model	Description	Serial Number	Cal. Due
Spectrum analyzer	Rohde & Schwarz	FSEA30	3.5 GHz	SSG013041	18-Apr-2007

The measurement instrumentation conforms to ANSI C63.2[6]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5.2 Field Strength of Spurious Emissions

5.2.1 Test Specification

The system was tested to the limits of the following requirements:

Table 5-4: Field Strength of Spurious Emissions Requirement

Requirement	Part / Section
FCC Part 15	15.231
RSS-210	A1.1.2 (1)

5.2.1.1 Limits

The following specification levels are worst-case limits taken from all test specifications. Their values are calculated at the end of this section.

Table 5-5: Field Strength of Fundamental Limit

Frequency Range (MHz)	Average detector Field Strength Limit at 10 m (dBuV/m)	Peak Detector Field Strength Limit at 10 m (dBuV/m)
433.92	70.3	89.7

Table 5-6: Field Strength of Spurious Emissions Limit

Frequency Range (MHz)	Average detector Field Strength Limit at 10 m (dBuV/m)	Peak Detector Field Strength Limit at 10 m (dBuV/m)
37.5-38.25	29.5	48.9
73-74.6	29.5	48.9
74.8-75.2	29.5	48.9
108-138	33.1	52.5
156.52475-156.52525	33.1	52.5
156.7-156.9	33.1	52.5
240-285	35.6	55.0
322-335.4	35.6	55.0
399.9-410	35.6	55.0

Frequency Range (MHz)	Average detector Field Strength Limit at 10 m (dBuV/m)	Peak Detector Field Strength Limit at 10 m (dBuV/m)
608-614	35.6	55.0
960-1427	43.5	62.9
1435-1626.5	43.5	62.9
1645.5-1646.5	43.5	62.9
1660-1710	43.5	62.9
1718.8-1722.2	43.5	62.9
2200-2300	43.5	62.9
2310-2390	43.5	62.9
2655-2900	43.5	62.9
3260-3267	43.5	62.9
3332-3339	43.5	62.9
3345.8-3358	43.5	62.9
3500-4400	43.5	62.9
All other frequencies between 30 and 4400 MHz	50.3	69.7

The Fundamental Emission limit was calculated using the requirement of FCC 15.231 b).

$$\begin{aligned} \text{Field Strength at 3 m} &= 41.6667 (F) - 7083.3333 \text{ uV/m at 3 m} \\ &= 10\,996.7 \text{ uV/m or } 80.8 \text{ dBuV/m} \end{aligned}$$

Where F is the transmitting frequency in MHz.

$$\begin{aligned} \text{Field Strength at 10 m} &= \text{Field Strength at 3 m} - 20 \log (10\text{m}/3\text{m}) \\ &= 70.3 \text{ dBuV/m} \end{aligned}$$

The Spurious Emissions limit is 20 dB lower than the limit for the Fundamental Emission.

The calculated fundamental and spurious emissions test limits above apply to measurements performed with an average detector.

The duty cycle of the transmitter is 10.7 %. This is demonstrated by Figure 5-2 and Figure 5-3.

This transmitter is a momentarily operated 433.92MHz Amplitude Shift Keyed (ASK) device. It is ON OFF Keyed (OOK). RF Transmission only occurs when Data is HI. A Data LO equates to a lack of RF transmission.

The first plot shows that the transmit burst is transmitted over a period of 103.3 ms. The second plot shows that the transmit burst lasts 19.5 ms and is approximately halfway composed of ON transmit pulses. The manufacturer states that 106 of the 187 bits transmitted are HI (transmit on).

$$\text{Duty Cycle} = (106/187) \times (19.5/103.3)$$

= 0.107 or 10.7 %

Therefore, field strength measurements performed with a average detector will be 19.4 dB lower (20 log(0.1070)) than measurements done with a peak detector.

Figure 5-2 Transmit Burst Period

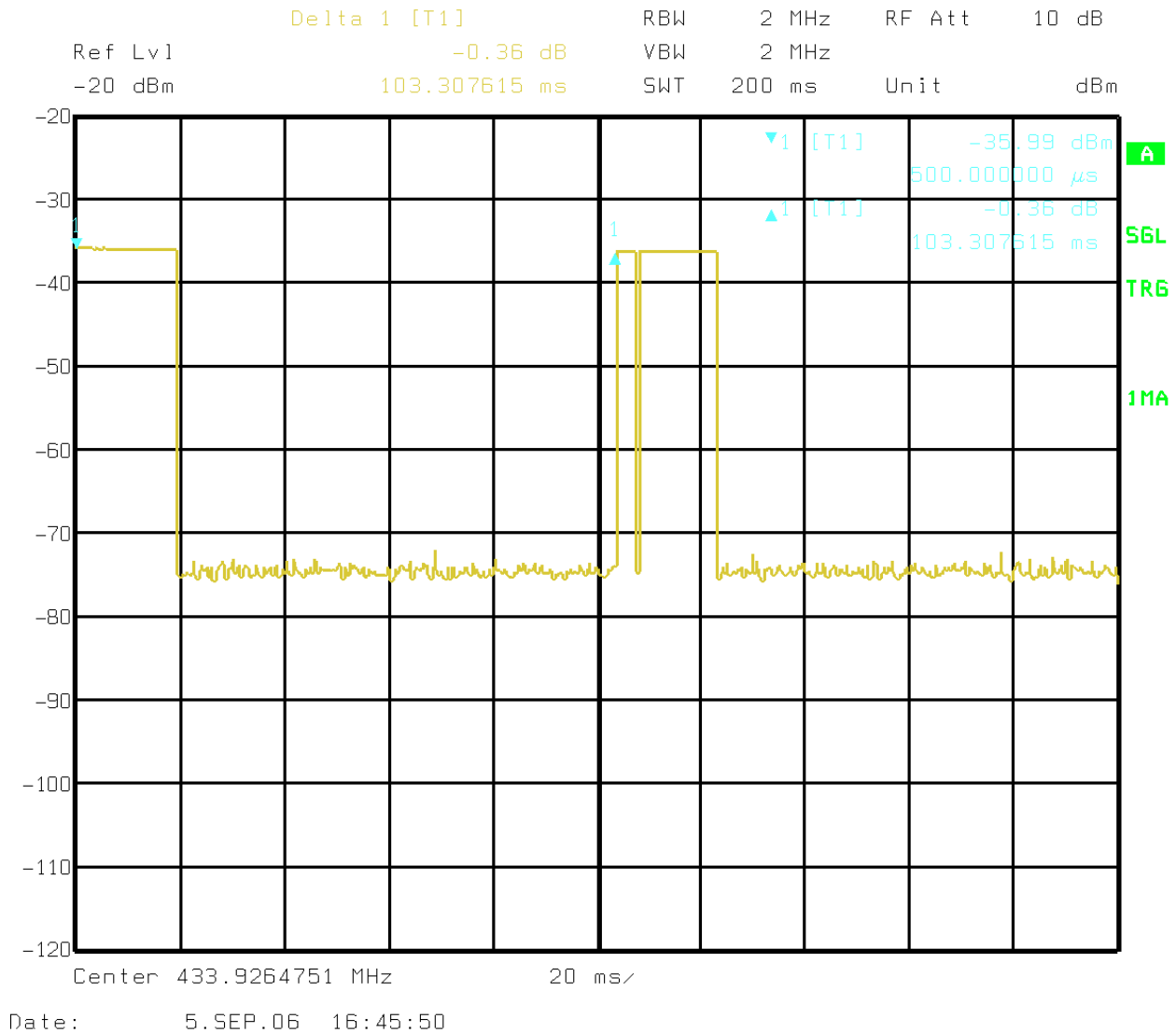
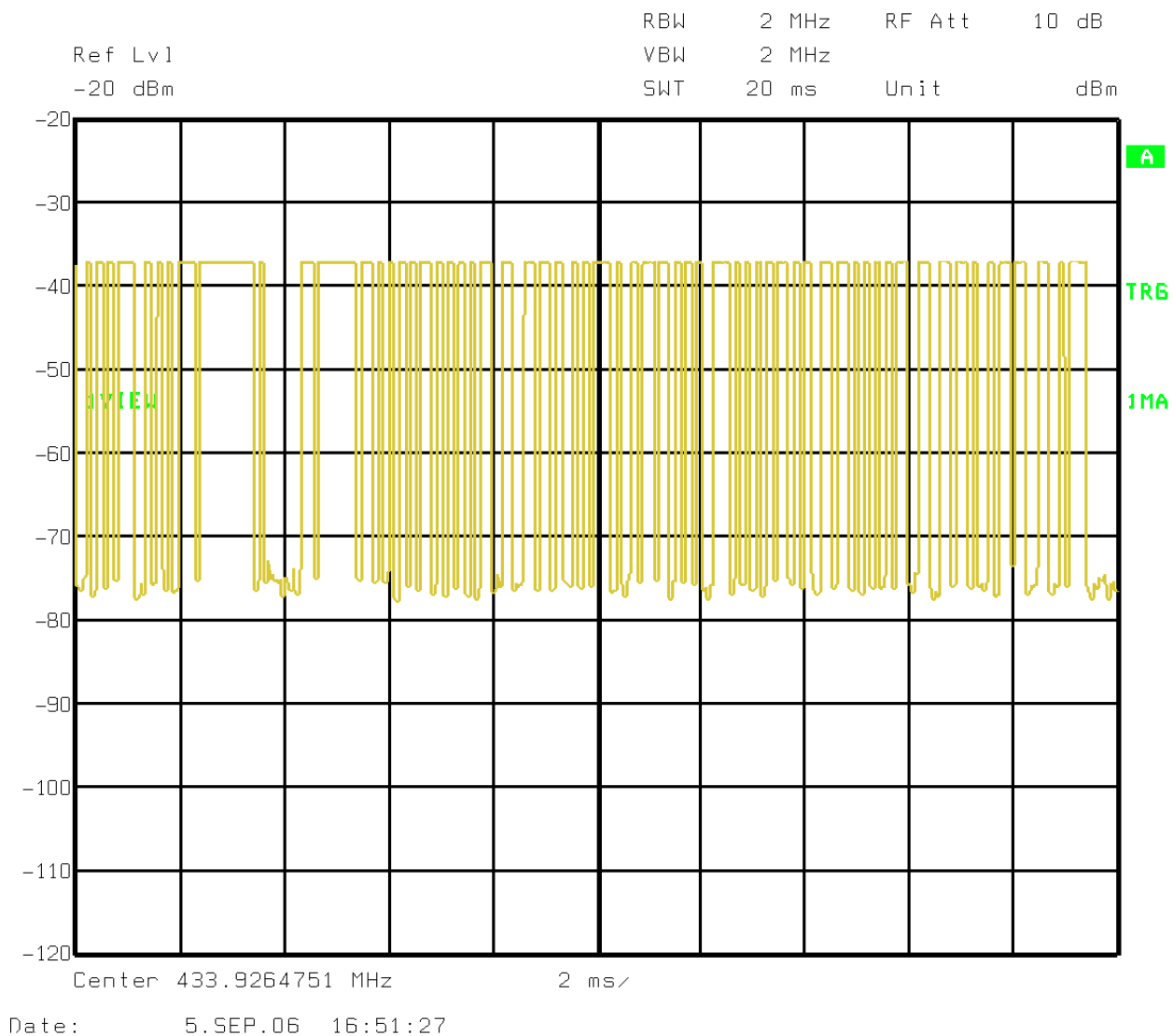


Figure 5-3 Transmit Burst Duty Cycle

5.2.2 Test Facility Information

Location: Soletron Design and Engineering 10m Ambient Free Chamber
Date tested: September 5, 2006
Tested by: S. Turner and D. Lalonde

5.2.3 Test Procedure

Verifications of the test equipment and AFC was performed prior to the installation of the EUT in accordance with the quality assurance procedures in KP000270-LP-EMC-01-08 [8]. The test was performed as per the relevant test procedures in ANSI C63.4 [5]:

The system was tested in the following manner:

- The EUT was placed on a turntable inside the AFC and it was configured to transmit continuously. The EUT was mounted on a wooden table with 0.8 m height.
- For tests between 30 MHz and 1 GHz a broadband bilog antenna was placed at a 10 m distance; a horn antenna, placed also at 10 m distance from the EUT, was used for measurements between 1 GHz and 4.5 GHz.
- A pre-scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan (using a peak detector) was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 meters, in steps of 1 meter, and for horizontal and vertical polarizations of the receiving antenna (for measurements above 30 MHz).
- Prescan optimization was performed based on the pre-scan data. All frequencies, having emission levels within 10 dB of the specification(s) limits, were optimized. For each such frequency, the EUT was rotated in azimuth over 360 degrees and the direction of maximum emission was noted. Antenna height was then varied from 1 to 4 meters at this azimuth to obtain maximum emissions. The procedure was repeated for both horizontal and vertical polarizations of the search antenna. Then the maximum level measured was recorded.
- The frequency range investigated was 30 MHz to 4.5 GHz.
- Between 30 MHz and 1 GHz, a resolution bandwidth of 120 kHz was used.
- Above 1 GHz, a 1 MHz resolution bandwidth was used.
- For tests between 800 MHz and 4.5 GHz an 800 MHz high pass filter was used to prevent saturation of the spectrum analyzer.
- All measurements were done using a peak detector.

5.2.4 Test Results

Table 5-7 lists the highest emissions measured while the transmitter was on continuously, all other emissions had more than 20 dB margin. Plots of the prescan data can be found in Appendix C: Field Strength of Spurious Emissions Plots.

Table 5-7: Fundamental Emission Field Strength Test Results @ 10m

Parameter	Unit	Fundamental Emission
Frequency	MHz	433.92
Azimuth	deg	160
Height	cm	378
Polarization		Vert
Meter Reading	dB(μ V)	96.9
Detector	PK, QP, AV	pk
Gain / Loss Factor	dB	-24.2
Transducer Factor	dB	16
Level	dB(μ V/m)	88.7
Margin to FCC Part 15	dB	1.0

Table 5-8: Spurious Emission Field Strength Test Results @ 10m

Parameter	Unit	Spurious Emission 1	Spurious Emission 2	Spurious Emission 3	Spurious Emission 4
Frequency	MHz	1301.682	1735.75	2169.596	3907.728
Azimuth	deg	99	152	147	359
Height	cm	102	104	287	300
Polarization		Vert	Vert	Vert	Horz
Meter Reading	dB(μ V)	43.53	40.08	59.66	32.8
Detector	PK, QP, AV	pk	pk	pk	pk
Gain / Loss Factor	dB	-36.8	-35.7	-35	-33
Transducer Factor	dB	25.4	26.7	27.7	31.9
Level	dB(μ V/m)	32.1	31.1	52.4	31.7
Margin to FCC Part 15	dB	30.8	38.6	17.3	31.2

5.2.5 Test Conclusion

The test results meet the requirements defined in Table 5-4: Field Strength of Spurious Emissions Requirement.

5.2.6 Test Equipment List

Table 5-9: Test Equipment used for Field Strength of Spurious Emissions

Description	Make	Model Number	Asset Number	Cal. Due
6 dB Attenuator	Aeroflex/Weinschel	47-6-43	SSG013067	4/18/2007
Spectrum Analyzer HP8566B (AFC #1)	HP	8566B	SSG012521	4/18/2007
Spec. A, RF PreSelector, HP85685A	HP	85685A	SSG012010	4/18/2007
EMC Cable # 25, Sucotest Cable	Huber + Suhner	ST18/Nm/Nm/36	SSG012788	2/8/2007
Pre-Amplifier	BNR	LNA	SSG012360	2/9/2007
Quasi-Peak Adapter, HP85650A, (AFC # 2)	HP	85650A	SSG012620	4/12/2007
RF Amplifier, HP8447 # 2	HP	8447D	SSG012405	2/9/2007
EMC Cable # 12, Sucoflex Cable	Huber & Suhner	104PEA	SSG012716	4/19/2007
EMC Cable # 5, Sucoflex Cable	Huber & Suhner	104PEA	SSG012359	2/9/2007
EMC Cable # 2, Sucoflex Cable	Huber & Suhner	106A	SSG012453	2/7/2007
EMC Cable # 1, Sucoflex Cable	Huber & Suhner	106A	SSG012454	2/7/2007
Spectrum Analyzer Display, HP 85662A	HP	85662A	SSG012433	4/18/2007
High Pass Filter	Microwave Circuits, Inc.	H8008501	SSG012709	4/19/2007
Network Analyzer	HP	8753	SSG012381	8/02/2007

The measurement instrumentation conforms to ANSI C63.2 [6] and CISPR 16 [7]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

5.3 Occupied Bandwidth

5.3.1 Test Specification

The system occupied bandwidth was evaluated according to the specifications listed in Table 5-10:

Table 5-10: Occupied Bandwidth

Requirement	Part / Section
FCC Part 15	15.231 c)
RSP-210	A1.1.3

5.3.1.1 Limits

The specified limit is shown in Table 5-11.

Table 5-11: Transmitter Maximum Bandwidth

Frequency (MHz)	Maximum Bandwidth 0.25% x Tx Frequency (kHz)
433.92	1084.8

5.3.2 Test Facility Information

Location: Soletron Design and Engineering Lab 1

Date tested: September 8, 2006

Tested by: Denis Lalonde

5.3.3 Test Procedure

The 20 dB and 99 % bandwidth measurements were performed at 433.92 MHz. The modulated signal was evaluated by setting the transmitter in continuous transmission mode and using the peak hold feature of the spectrum analyzer.

The 20 dB bandwidth was determined by finding the peak of the transmitted signal and the -20 dB points on each side of the peak. The 20 dB bandwidth is the difference in frequency between the -20 dB points.

The occupied bandwidth was measured using the 99% bandwidth measuring feature of the spectrum analyzer.

5.3.4 Test Results

The table below lists the calculated and measured occupied bandwidth.

Table 5-12: Occupied bandwidth values

Type of signal	20 dB Bandwidth Measurement (kHz)	99% Bandwidth Measurement (kHz)
OOK	16.1 kHz Figure 7-5	52.7 kHz Figure 7-6

The measured transmitter bandwidth is less than 0.25% of the transmitter frequency.

5.3.5 Test Conclusion

The test results meet the requirements defined Table 5-10.

5.3.6 Test Equipment List

Table 5-13: Test Equipment used for Occupied bandwidth

Category	Manufacture	Model	Description	Serial Number	Cal. Due
Spectrum analyzer	Rohde & Schwarz	FSEA30	3.5 GHz	SSG013041	18-Apr-2007

The measurement instrumentation conforms to ANSI C63.2 [6]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

6. References

6.1 Applicable documents

1. [KP000938-TP-EMC-84-01] Test Plan

6.2 References Documents

2. Standards Council of Canada, Scope of Accreditation for Soletron EMS Canada Inc. outlined at the following web site http://palcan.scc.ca/specs/pdf/95_e.pdf
3. Soletron EMS Canada Inc. Quality Manual, K0000608-QD-QM-01-09, July 4 2006.
4. Soletron EMS Canada Inc. Lab Operations Manual KG000347-QD-LAB-01-08, July 4 2006.
5. ANSI C63.4-2003 for FCC CFR 47 and ANSI C63.4-2001 for Telcordia, Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, 06 June 2001.
6. ANSI C63.2-1996, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz – Specifications.
7. CISPR 16 Publications (2003), Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1: Radio Disturbance and Immunity Measuring Apparatus.
8. Soletron EMS Canada Inc., EMC General Lab Test Procedure, KP000270-LP-EMC-01-08, July 6, 2006.
9. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations, Part 2, U.S. Federal Communications Commission.
10. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations, Part 15, U.S. Federal Communications Commission, 2005.
11. RSS-210, Issue 6, “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment” September 25, 2005.
12. APLAC, Asia Pacific Laboratory Accreditation Cooperation, Website (February 10th, 2004): <http://www.aplac.org>.
13. ILAC, International Laboratory Accreditation Cooperation, Website (February 10th, 2004): <http://www.ilac.org/>
14. Industry Canada, RSS 212, Test Facilities and Test Methods for Radio Equipment, Issue 1 (Provisional), February 27, 1999.
15. ISO/IEC 17025:2005, General Requirements for the competence of testing and calibration laboratories, second edition 2005/05/15.
16. ISO 9001:2000, Quality Management Systems – Requirements, third edition, 2000/12/15.

7. Appendices

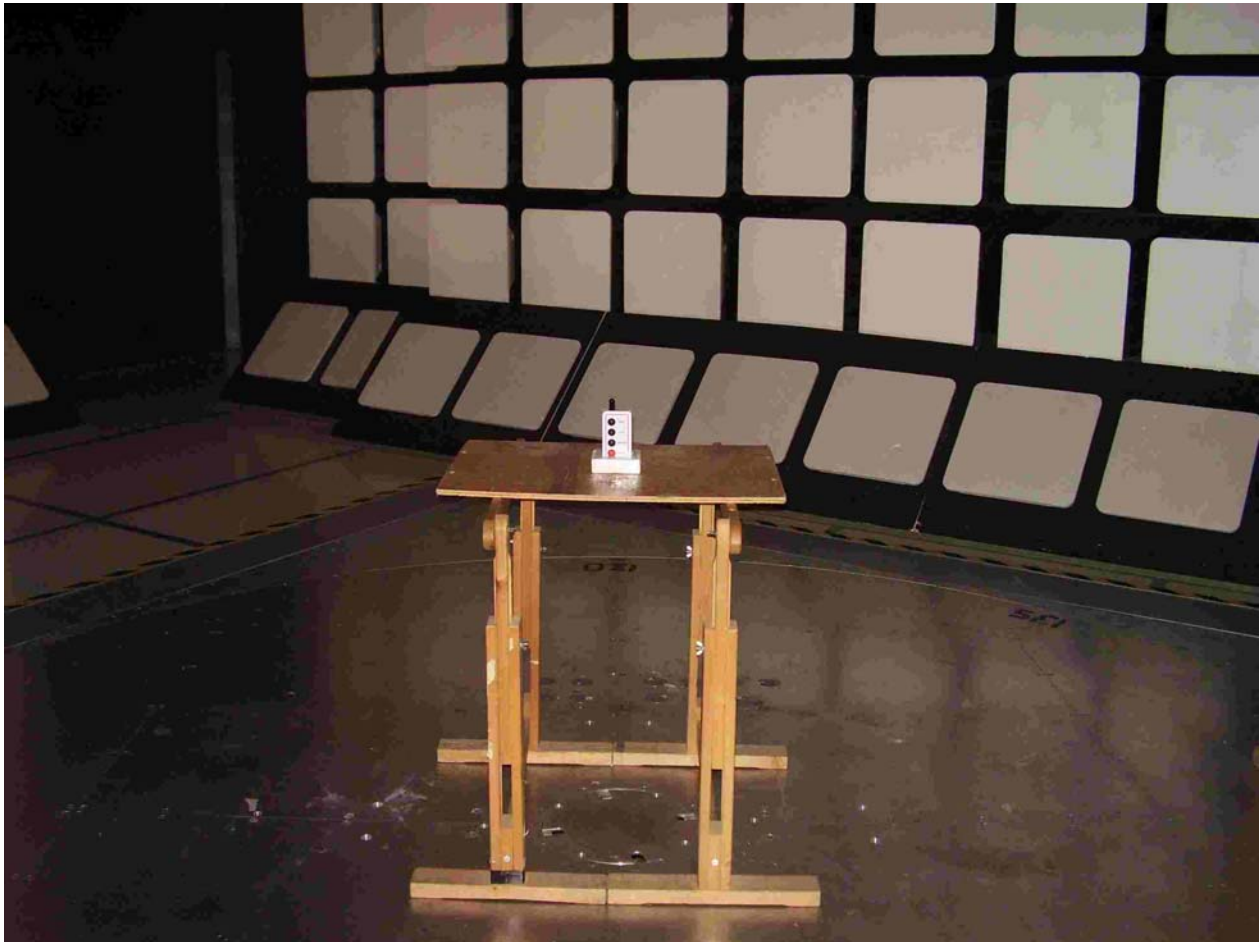
7.1 Appendix A: Glossary

Included below are definitions and abbreviations of terms used in this document.

Term	Definition
AC	Alternating Current
AFC	Ambient Free Chamber
AM	Amplitude modulation
ANSI	American National Standards Institute
AVG	Average detector
CISPR	Comité International Spécial Perturbation Radioélectrique (International Special Committee on Radio Interference)
Class A	Class A Limits for typical commercial establishments
Class B	Class B Limits for typical domestic and residential establishments
dB	Decibel
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	European Normative
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
GND	Ground
IC	Industry Canada
PA	Broadband Power Amplifier
RBW	Resolution Bandwidth
RF	Radio-Frequency
RFI	Radio-Frequency Interference
SCC	Standards Council of Canada

7.2 Appendix B: Test Set-up Photographs

Figure 7-1: Base Engineering ASK Remote Radiated Emissions Set-up



7.3 Appendix C: Field Strength of Spurious Emissions Plots

This appendix presents all field strength plots for the test cases measured.

Figure 7-2: Field Strength, 30 MHz to 800 MHz

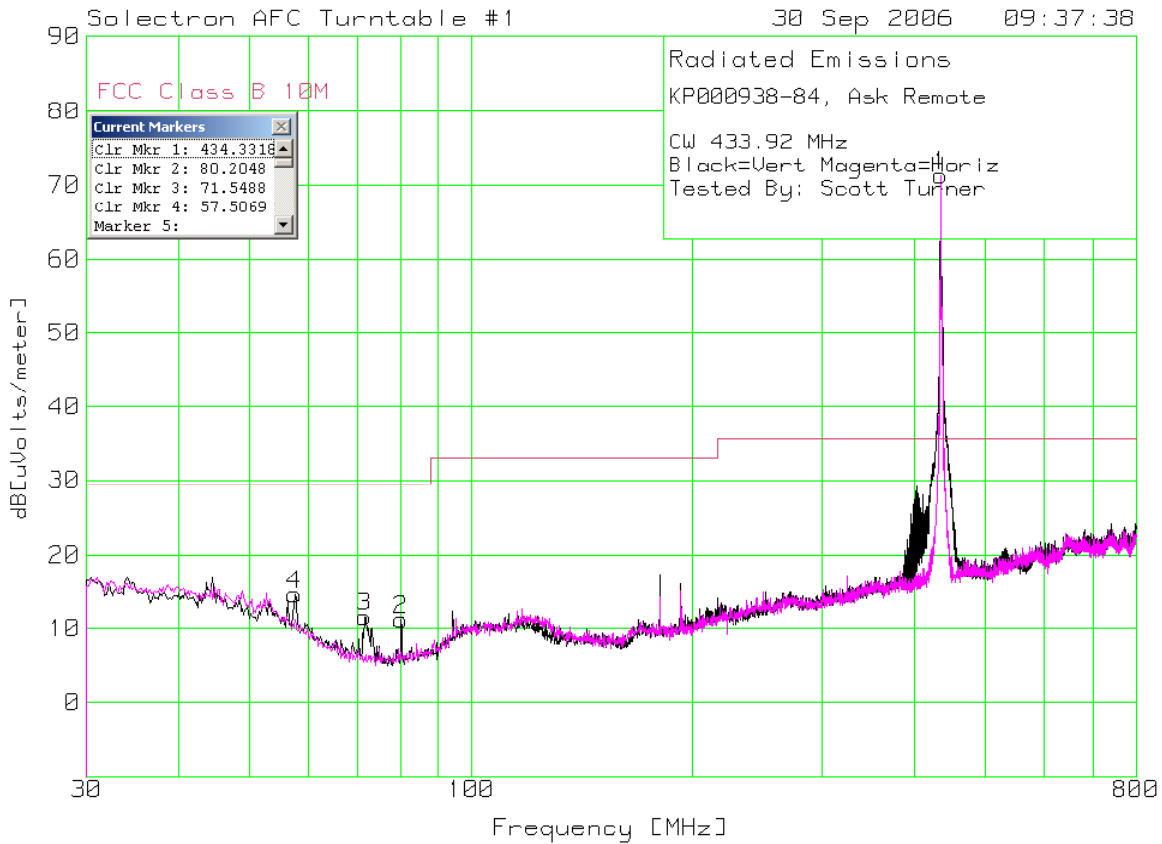


Figure 7-3: Field Strength, 800 MHz to 1 GHz

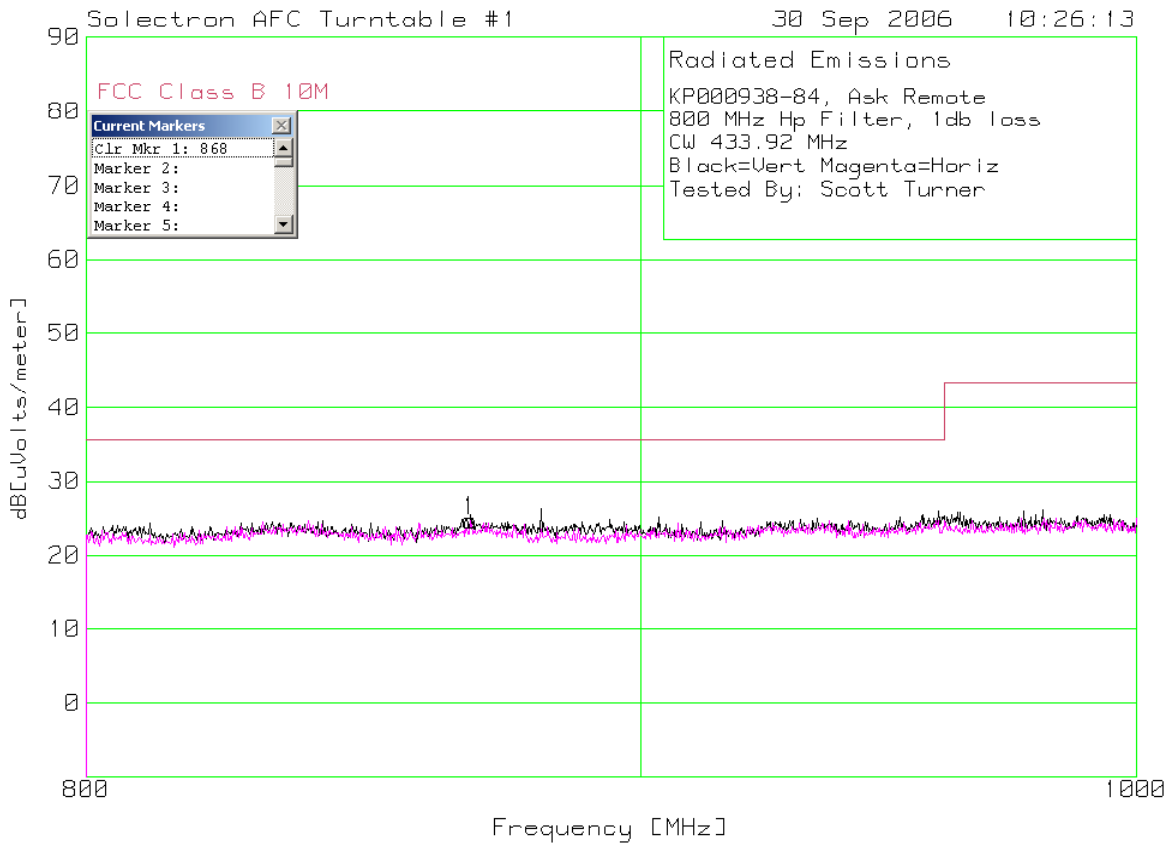
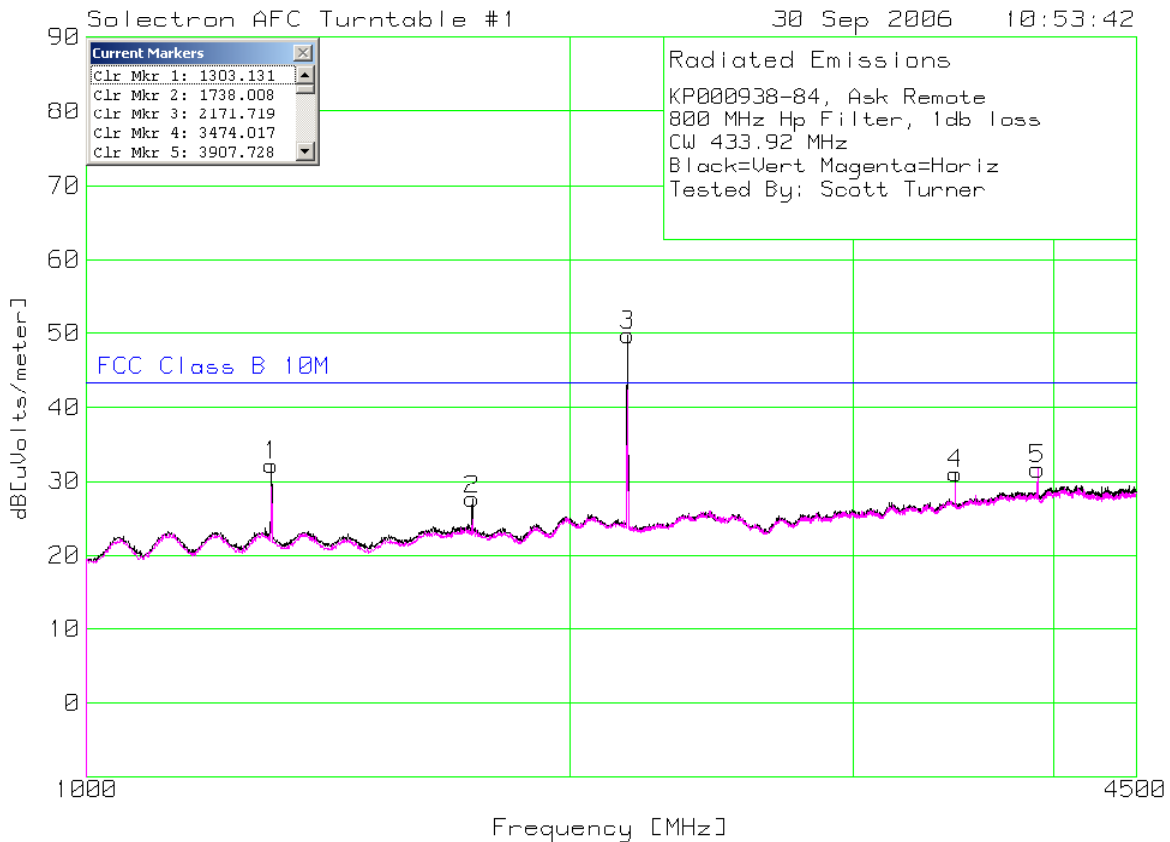


Figure 7-4: Field Strength, 1 GHz to 4.5 GHz



7.4 Appendix D: Occupied Bandwidth Plots

This appendix presents all the occupied bandwidth plots for the test cases measured.

Figure 7-5: 20 dB Bandwidth

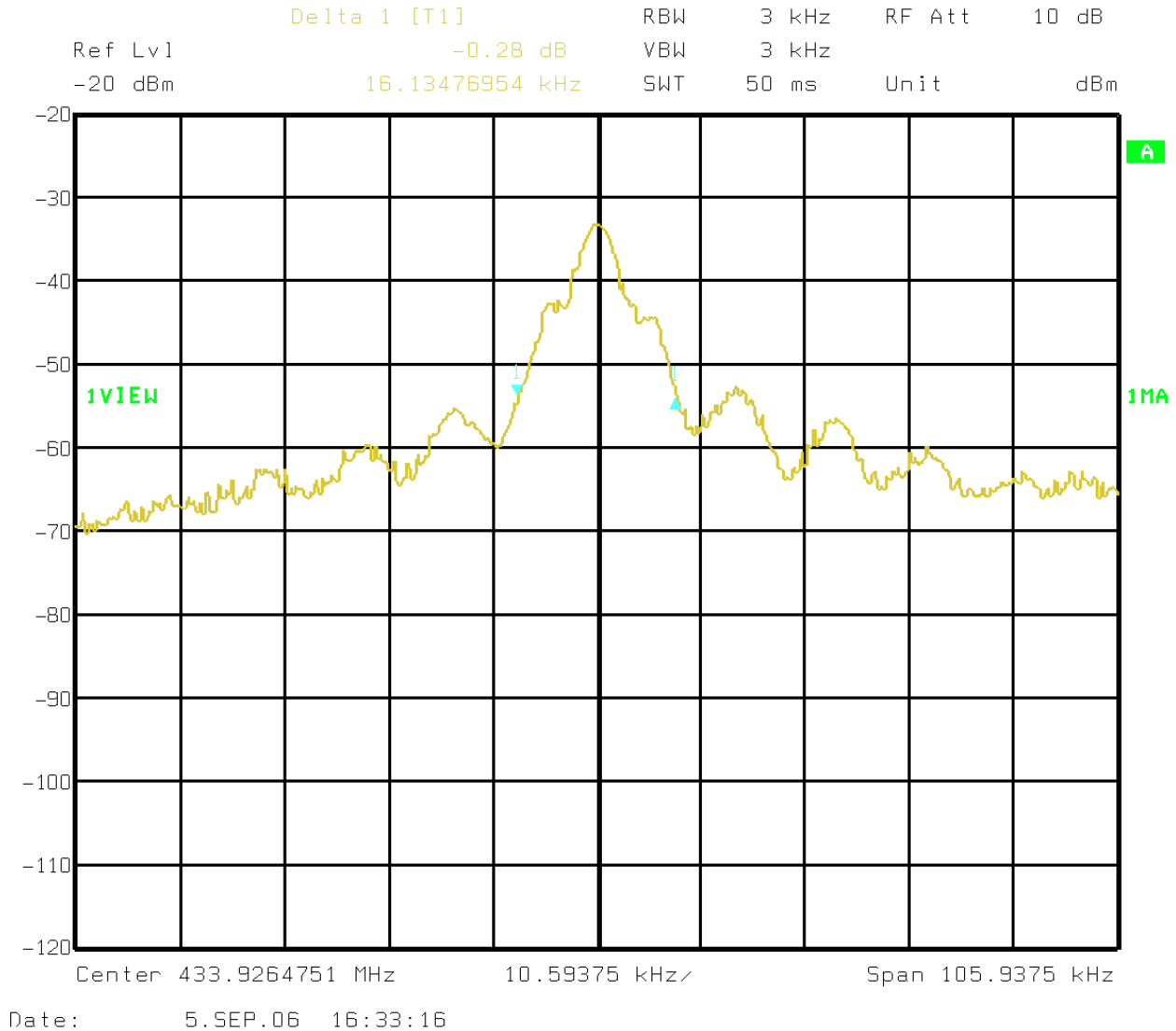
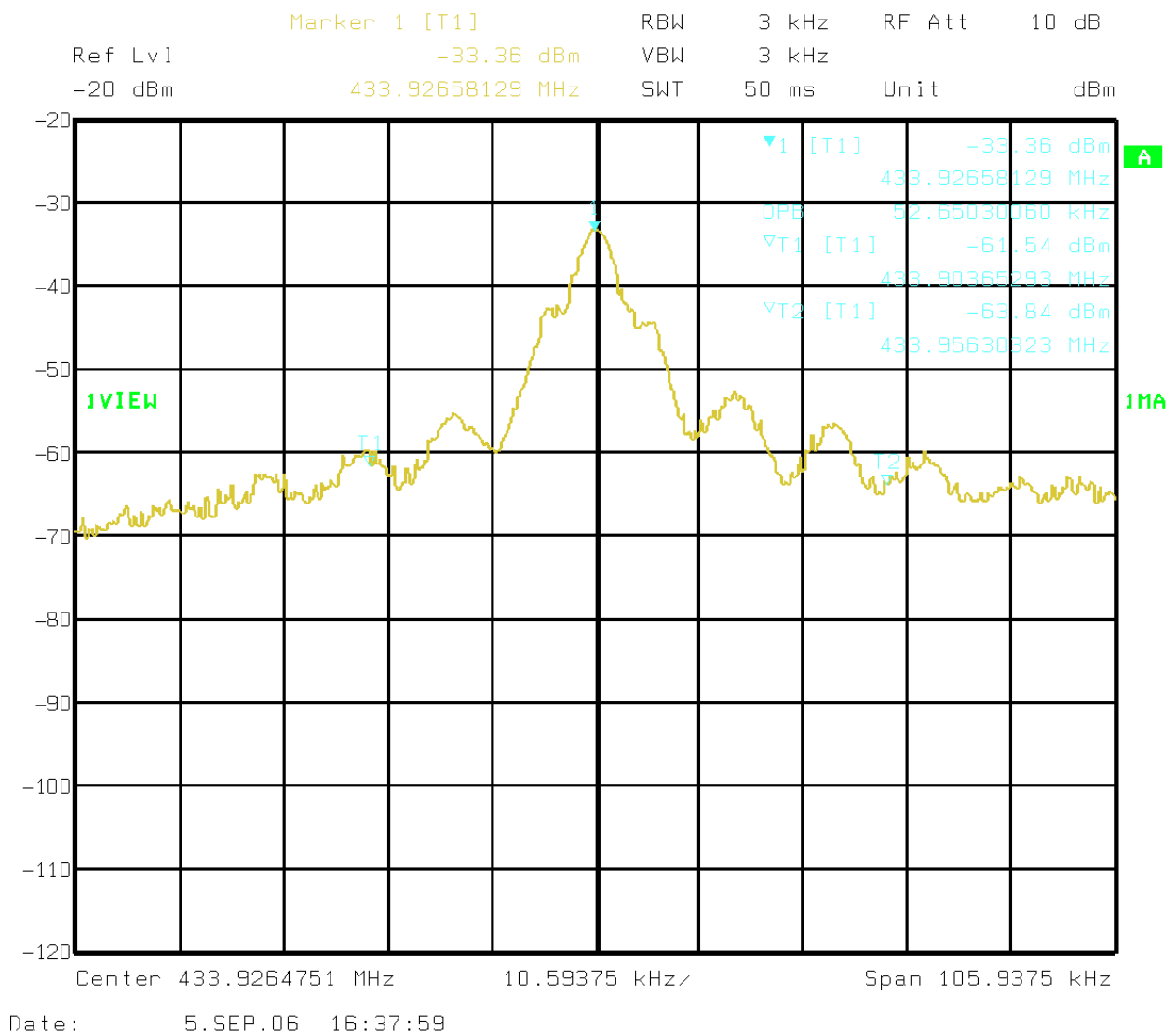


Figure 7-6: 2 99% Bandwidth



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Certification Report for the Base Engineering ASK Remote FCC Part 15 & RSS-210 End of Document

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